TECHNICAL MEMORANDUM ◦ DECEMBER 2022

2022 Chorro Creek Pikeminnow Suppression Efforts

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Cover photos: Efishing crew on Chorro Creek (top left), juvenile steelhead (top right), multiple size classes of Sacramento pikeminnow (bottom right) adult Sacramento pikeminnow (bottom right).

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1 INTRODUCTION

Adult pikeminnow captured in Chorro Creek

To benefit native steelhead (*Oncorhynchus mykiss*) in the Chorro Creek watershed, a Sacramento Pikeminnow (*Ptychocheilus grandis*) Management Plan (Management Plan) was developed for the watershed in 2017 (Stillwater Sciences 2017). The Management Plan was developed with input from a diverse technical advisory committee ranging from local biologists to pikeminnow experts to specifically address a recovery action that was included in the South-Central California Coast Steelhead Recovery Plan, "develop and implement non-native species monitoring program to track status and impacts of non-native species of plants and animals on all steelhead life history stages, particularly rearing juveniles (NMFS 2013)." The Management Plan was partially funded and implemented from 2017 through 2020. In 2021, the Morro Bay National Estuary Program (MBNEP) was awarded funding to fully implement the Management Plan for three years (2021 – 2023) through the California Department of Fish and Wildlife (CDFW) Proposition 1 Restoration Grant Program. This report summarizes data from the 2022 surveys and compares the results to data collected from 2017 through 2021.

1.1 Study Area

The Study Area for 2022 pikeminnow suppression efforts includes mainstem Chorro Creek from the tidal extent of Morro Bay upstream to Chorro Reservoir. The Study Area was divided into eight Study Reaches based primarily on access and landownership. Study Reaches sampled in 2022 included Chorro Flats, Chorro Creek Ecological Reserve (CCER), Cal Poly, California Department of Fish and Wildlife (CDFW) downstream of the Water Treatment Plant (d/s of WTP), CDFW upstream of the WTP (CDFW u/s of WTP), Camp San Luis Obispo (Camp SLO), and California Men's Colony (CMC) (Figure 1). Study Reaches and their corresponding multi-pass electrofishing locations sampled in 2022 are shown in Table 1.

Table 1. Study Reaches and corresponding multi-pass electrofishing locations sampled in 2022.

Study Reach	Multi-Pass Electrofishing Location
Chorro Flats	CF3
CCER	22.1
	25
	28
Cal Poly	9.1
	14
	14.1
CDFW	--[1]
Camp SLO	CS1
CMC	--[1]

[1] No multi-pass electrofishing location has been established.

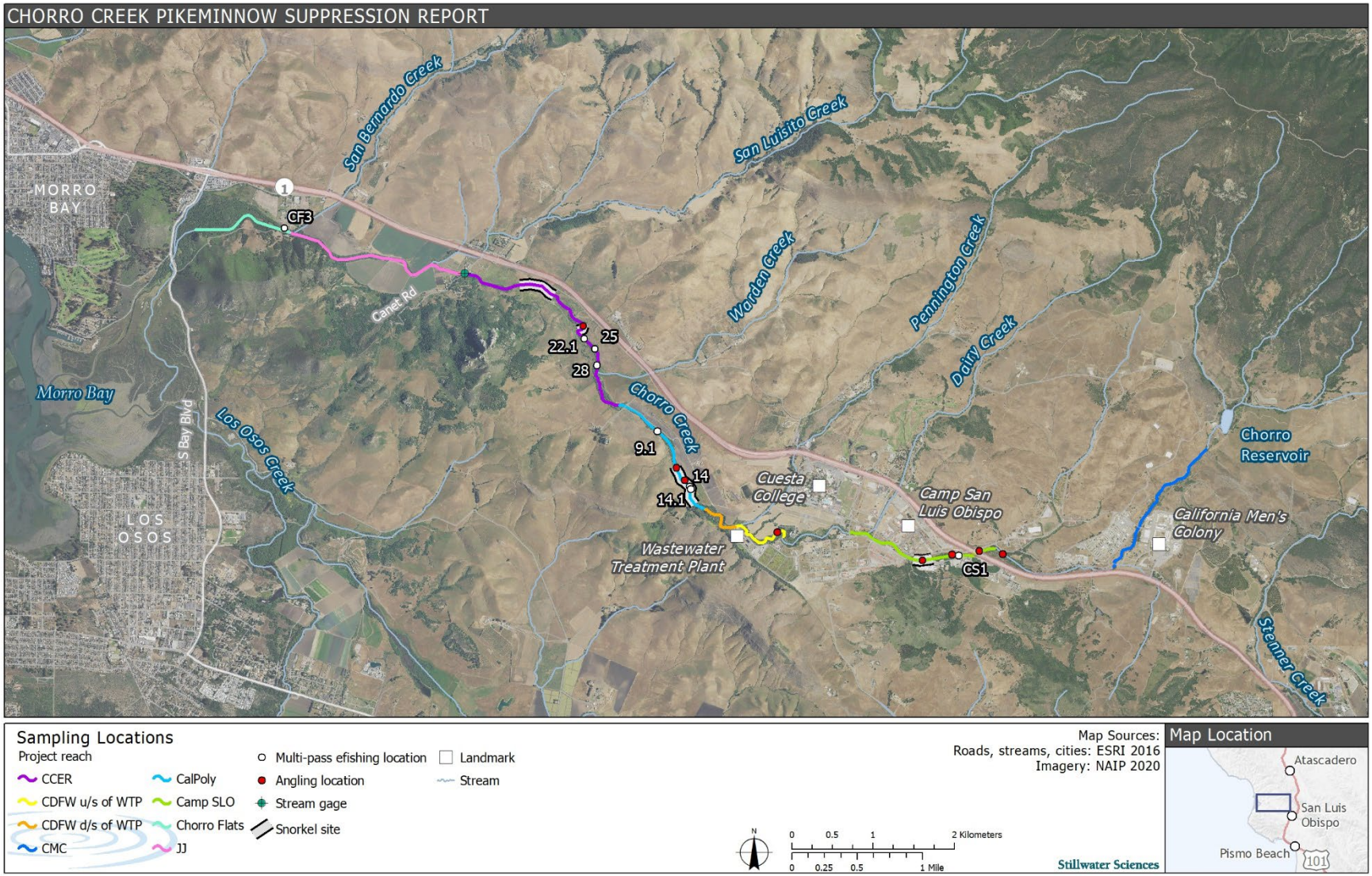


Figure 1. Study Area and high priority sampling locations within Study Reaches of Chorro Creek.

2 METHODS

Pikeminnow suppression was conducted using multi-pass and single pass backpack electrofishing and angling as described in the Management Plan (Stillwater Sciences 2017). Sampling efforts were primarily conducted during the fall when stream flows are at their lowest and pikeminnow are concentrated into smaller areas. The majority of the habitat in Chorro Creek during this time of year is less than 1.2 meters (m) in depth, which facilitates efficient pikeminnow capture with a backpack electrofisher (Adams et al. 2011). Details of the approach are described below.

2.1 Snorkeling

Snorkeling was conducted in Chorro Creek prior to the fall sampling effort to inform fish suppression efforts and prioritize sampling locations. Two snorkelers conducted single pass snorkel surveys moving in an upstream direction. Fish species observed were identified to species, assigned to a size bin (based on total length), and enumerated.

2.2 Multi-Pass Electrofishing

Multi-pass backpack electrofishing was conducted in habitat units previously selected for long term monitoring. Multi-pass electrofishing was conducted following methods by Pollock and Otto (1983) with the intention to capture as many pikeminnow as feasible, and to estimate habitat-unit specific density from which to determine the density of both steelhead and pikeminnow. Block nets were installed at the upstream and downstream ends of each multi-pass sampling unit to prevent migration in and out of the unit and to facilitate an accurate assessment of sample populations. Two biologists with Smith Root LR-24 backpack electrofishers and two or three netters began at the downstream block net and proceeded upstream, working closely together. As fish were captured (netted), they were placed in buckets with aerated stream water until the completion of the pass. A minimum of three passes were conducted within each segment. If there was poor depletion after three passes, a fourth pass was performed.

Electrofishing crew in Chorro Creek

All captured pikeminnow and steelhead were identified to species and measured to both standard length (SL) and fork length (FL). Other fish species captured were identified to species, enumerated, and a subset of up to 50

individuals were measured to SL and FL. All pikeminnow captured were humanely euthanized using methods included in the American Veterinary Medical Association (AVMA 2013) guidelines and all other fish were returned to the stream after measuring. Gut content analysis was conducted on pikeminnow over approximately 150 millimeters (mm) (SL), which involved dissecting the fish's stomach and visually identifying any objects observed in the stomach.

Large adult pikeminnow captured in Chorro Creek

2.3 Single Pass Electrofishing

Single pass backpack electrofishing was conducted in Chorro Creek Study Reaches to remove pikeminnow, increase sample size for various habitat unit types, and document species distribution patterns and relative abundance for pikeminnow and steelhead. For locations sampled using single pass backpack electrofishing, two biologists with Smith Root LR-24 backpack electrofishers and two or three netters began at the downstream end of the habitat unit and proceeded upstream either to the top of the unit or through multiple units within a stream section. As fish were captured (netted), they were placed in buckets with aerated stream water. Once enough fish were captured or over 100 m of stream was sampled, fish were processed as discussed above in Section 2.2.

2.4 Angling

Angling was conducted in locations previously identified as pikeminnow "hot spots" where subadult/adult pikeminnow (fish >180 mm SL) were previously observed in high abundance and where habitat conditions limit the effectiveness of backpack electrofishing due to depths >1.2 m or a combination of water depth and extensive cover (e.g., log jams and overhanging branches). Angling was conducted by one or two biologists using artificial lures with barbless hooks. All fish captured during angling were processed as discussed above in Section 2.2.

2.5 Analysis

Fish capture numbers from the 2022 sampling effort were compared with results from previous sampling efforts conducted from 2017–2021 for those sampling reaches that were repeated to assess trends in abundance and distribution. A length frequency histogram was generated to estimate pikeminnow and steelhead age classes based on fish size. Relative abundance for steelhead and pikeminnow was standardized to a unit length of 100 m by dividing the number of fish captured by the habitat unit length sampled during a given year, then multiplied by 100 m. Fish density estimates with 95% confidence intervals were calculated at habitat units surveyed by multiple pass depletion between 2017–2022 for steelhead and pikeminnow using the FSA: Fisheries Stock Assessment package, implemented in R (Ogle et al. 2020, R Core Team 2020).

3 RESULTS

A total of 209 pikeminnow and 188 steelhead were captured in Chorro Creek during surveys conducted in 2022. A total of 1,047 pikeminnow have been removed from Chorro Creek during suppression efforts from 2017–2022. The ratio of steelhead to pikeminnow shifted from higher proportions of steelhead from 2018 through 2021 to a higher proportion of pikeminnow in 2022 (Table 2). This shift was likely in part due to the lack of sampling in the JJ Study Reach during 2022, where steelhead were typically captured in high densities and pikeminnow were rare (Table 2). However, the ratio of steelhead to pikeminnow captured in 2022 (8:10) was still much higher than in 2017 when the ratio of steelhead to pikeminnow captured was 1:10.

Table 2. Fish captured and ratio of pikeminnow to steelhead in Chorro Creek during sampling conducted in 2017-2022.

Native or Introduced	Species	2017	2018	2019	2020	2021	2022	Total
Native	Steelhead	23	107	260	479	238	188	**1,295**
	Speckled dace	122	99	317	255	208	162	**1,163**
	Three-spine stickleback	134	39	69	45	365	218	**870**
	Prickly sculpin	0	0	0	0	0	2	**2**
Introduced	Pikeminnow	224	88	218	117	191	209	**1,047**
	Sacramento sucker	180	26	173	146	935	273	**1,733**
	Largemouth bass	0	2	0	0	0	2	**4**
	Bluegill	0	0	2	0	39	21	**62**
	Green sunfish	0	0	0	1	0	0	**1**
	Mosquito fish	0	0	0	0	14	10	**24**
Total		**683**	**361**	**1,039**	**1,043**	**1,990**	**1,088**	**6,204**
Ratio of steelhead to pikeminnow		**1:10**	**12:10**	**12:10**	**41:10**	**12:10**	**8:10**	**10:12**

3.1 Age Class

Pikeminnow captured in 2022 ranged in length from 39 mm SL to 360 mm SL and steelhead ranged from 39 mm SL to 260 mm SL. Pikeminnow less than or equal to 70 mm SL are estimated to be young-of-year (YOY), while steelhead less than or equal to 120 mm SL are estimated to be YOY, based on the length frequency distribution of fish captured (Figure 2) and age-classes reported in literature (Moyle 2002, Bell et al. 2011, Hayes et al. 2008). Most steelhead captured were YOY with some older individuals up to age 3+ (Figure 2).

Multiple age classes of pikeminnow captured in Chorro Creek

Pikeminnow exhibited a wider age class distribution, with most individuals aged YOY and age 1+, with a few pikeminnow likely over age 5+ (Figure 2).

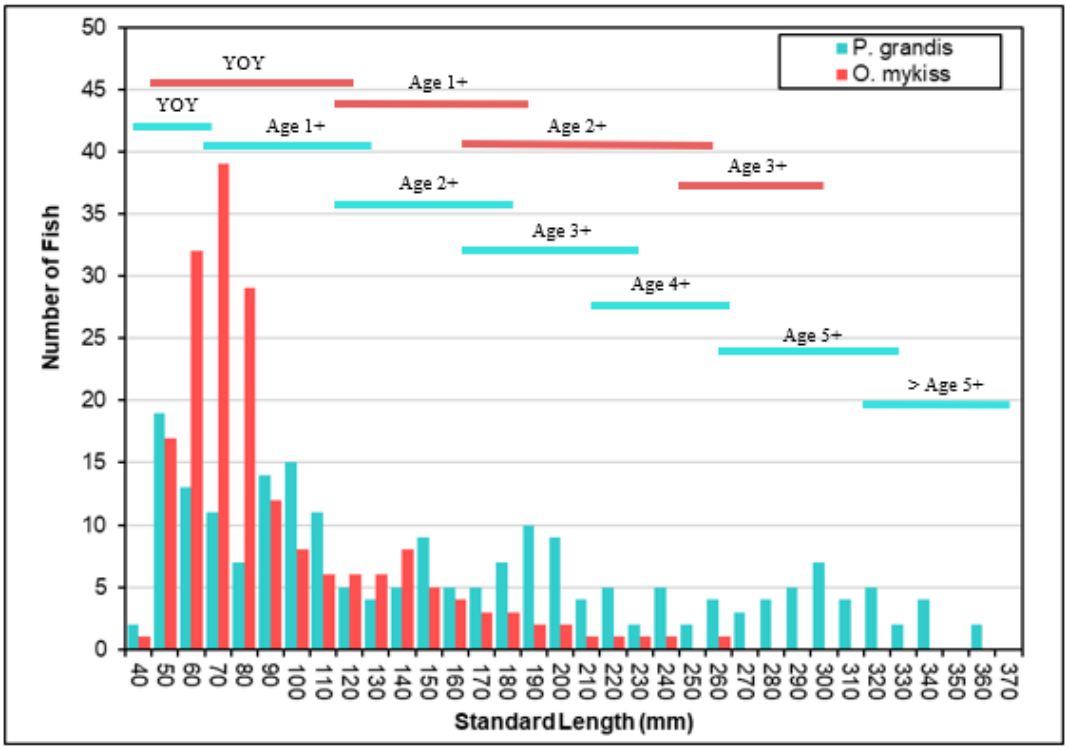


Figure 2. Length frequency distribution for pikeminnow and steelhead captured in 2022.

3.2 Composition

In 2022, nine fish species were captured in Chorro Creek including steelhead, pikeminnow, speckled dace (*Rhinichthys osculus*), Sacramento sucker (*Catostomus occidentalis*), three-spine stickleback (*Gasterosteus aculeatus*), prickly sculpin (*Cottus asper*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and Western mosquitofish (*Gambusia affinis*) (Figure 3). Prickly sculpin have not been observed in prior survey years and were present in the CMC and Chorro Flats Study Reaches. Overall, species composition was more evenly represented in 2022 compared to previous years (Figure 3).

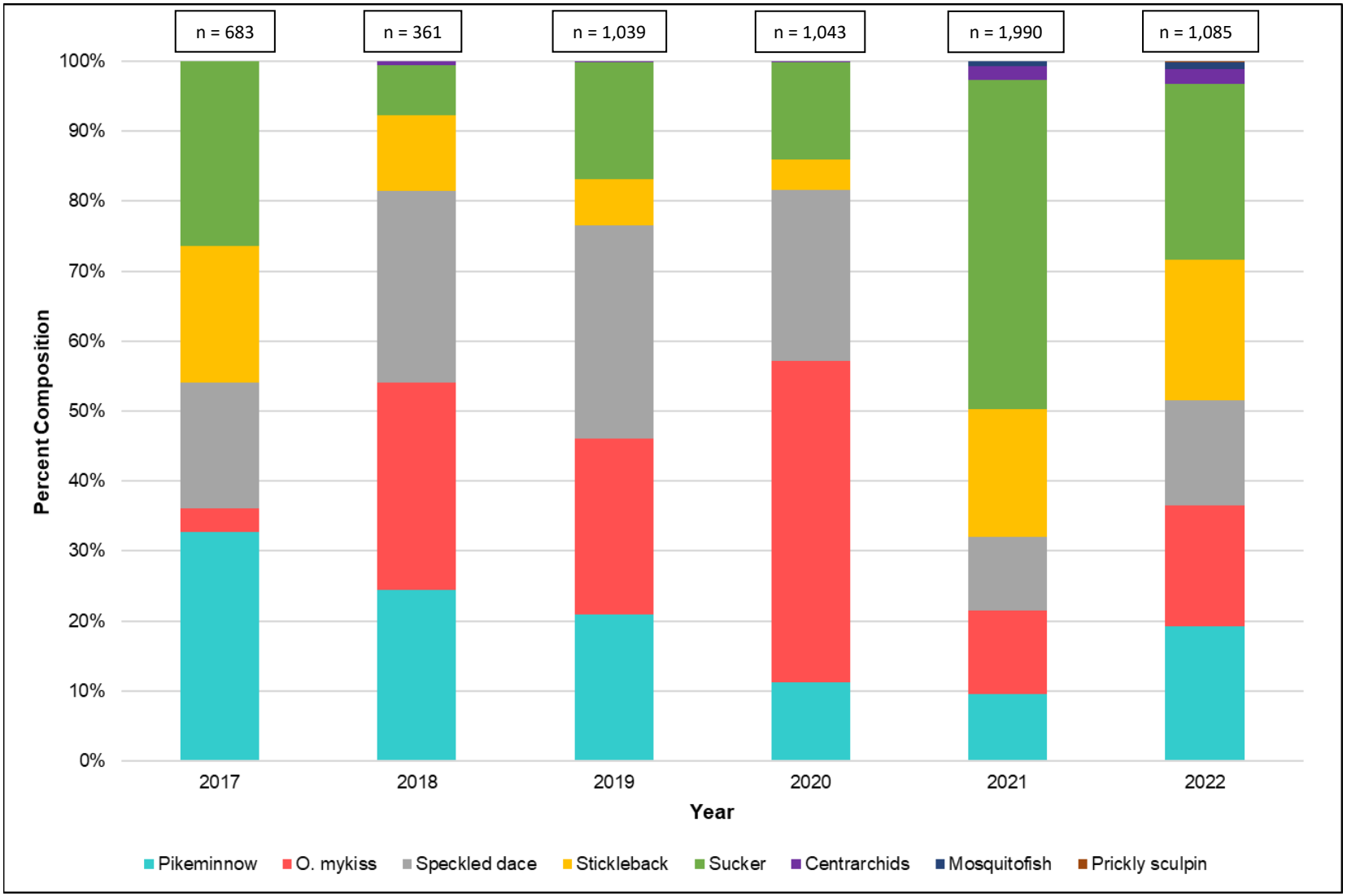


Figure 3. Percent composition for fish captured in Chorro Creek during sampling conducted in 2017–2022.

3.3 Distribution

In general, pikeminnow distribution appears to be limited in the lower watershed with higher observed concentrations in the upper Study Reaches. Steelhead were distributed throughout the middle Study Reaches, with the highest concentrations in the CCER and Camp SLO Study Reaches (Figure 4). Pikeminnow snorkel observations were highest in the Cal Poly Study Reach while electofishing capture numbers were highest in the CMC Study Reach (Table 3 and Figure 4). Steelhead snorkel observations were highest in the Camp SLO Study Reach while electrofishing capture numbers were highest in the CCER Study Reach (Table 3 and Figure 4). Pikeminnow were rare in the Chorro Flats Study Reach, and none were captured in the CCER Study Reach. Pikeminnow capture numbers generally increased at each subsequent upstream Study Reach, with the exception of the Camp SLO Study Reach, where pikeminnow numbers decreased. Backpack electrofishing efforts conducted in the CMC Study Reach resulted in high numbers of pikeminnow and no steelhead in 2022 (Figure 4).

Table 3. Fish species observations by Study Reach during snorkel surveys, 2022.

Snorkel Reach*	Pikeminnow			O. mykiss				Other Species			
	<200 mm	>201 mm	Total	<100 mm	101–200 mm	201–300 mm	Total	Stickle back	Speckled dace	Sac. sucker	Bluegill
CCER	6	0	**6**	6	3	1	**10**	4	0	0	0
Cal Poly	96	14	**110**	2	5	3	**10**	4	11	5	0
Camp SLO	63	9	**72**	21	16	6	**43**	24	29	27	2

* no snorkeling occurred on the CMC, JJ, or Chorro Flats Study Reaches in 2022.

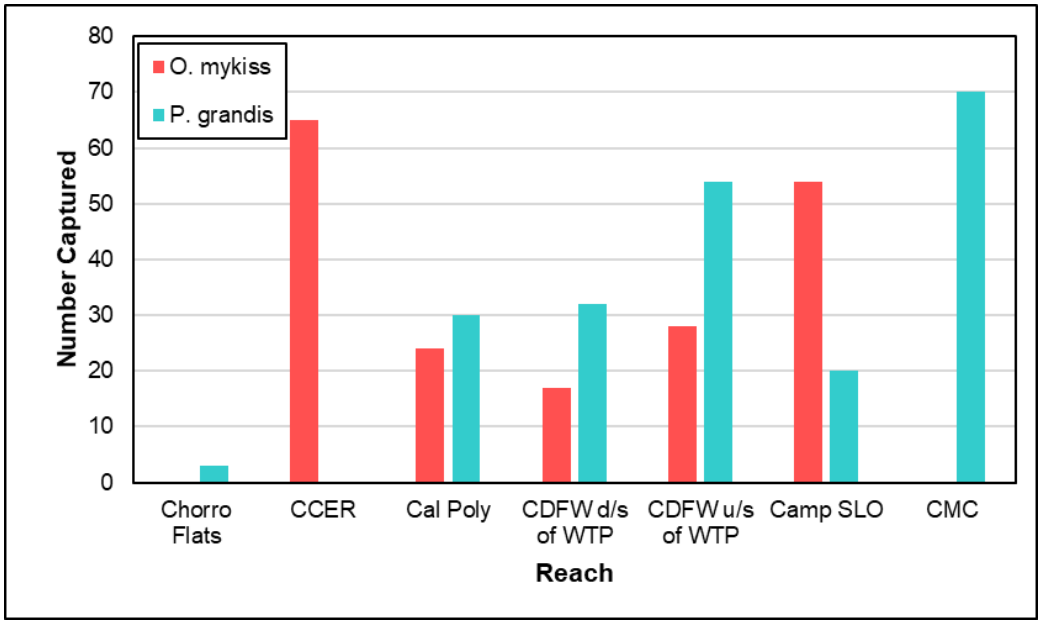
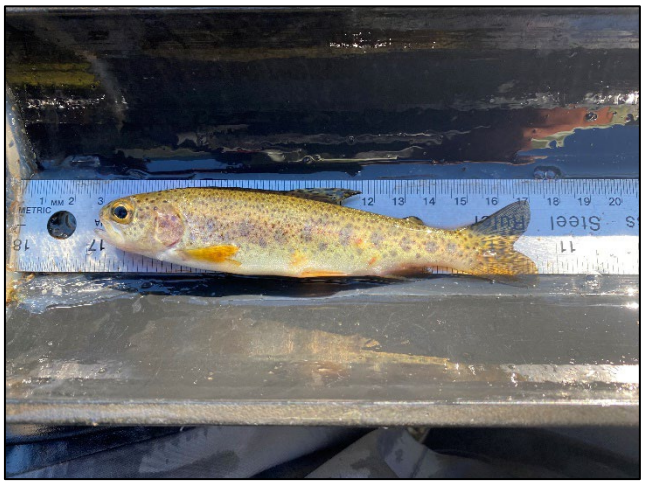


Figure 4. Steelhead and pikeminnow catch numbers (all methods) by Study Reach (from downstream [left] to upstream [right]) in 2022.
Note: JJ Study Reach was not surveyed in 2022

3.4 Abundance and Density

Pikeminnow abundance and density tended to be higher within the upstream extent of the Study Area across all sample years (Figure 5 and Figure 6). In 2022, fish greater than 70 mm SL made up the greatest proportion of pikeminnow and steelhead densities at all sites except the CCER Study Reach (Figure 5). Steelhead were not observed in the CMC or Chorro Flats Study Reaches in 2022. In 2022, steelhead abundance and density were highest in the CCER Study Reach while pikeminnow abundance was highest in the CDFW u/s of the WTP Study Reach and pikeminnow densities were highest in the Cal Poly Study Reach (Figure 5 and Figure 6). Pikeminnow abundance fluctuated between years and was most apparent in pikeminnow less than 70 mm SL (Figure 5 and Figure 6). Steelhead abundance also fluctuated between years but was lowest during 2017 when only a few fish greater than 70 mm SL were observed (Figure 6).



Juvenile steelhead captured in Chorro Creek

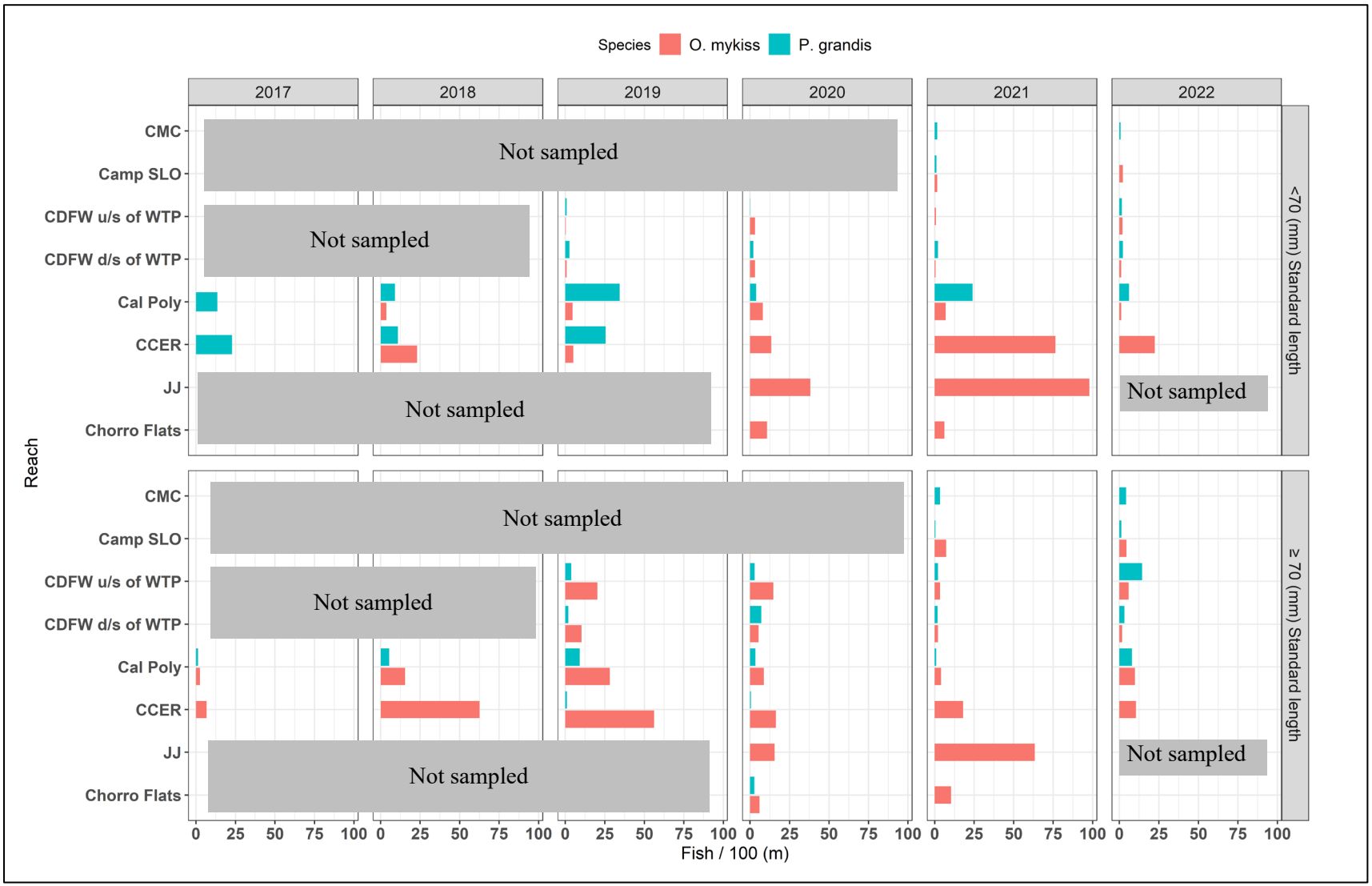


Figure 5. Relative abundance steelhead and pikeminnow based on single pass electrofishing (single pass includes 1st pass from multi-pass locations and single pass locations). Habitat units are ordered from downstream (bottom) to upstream (top).

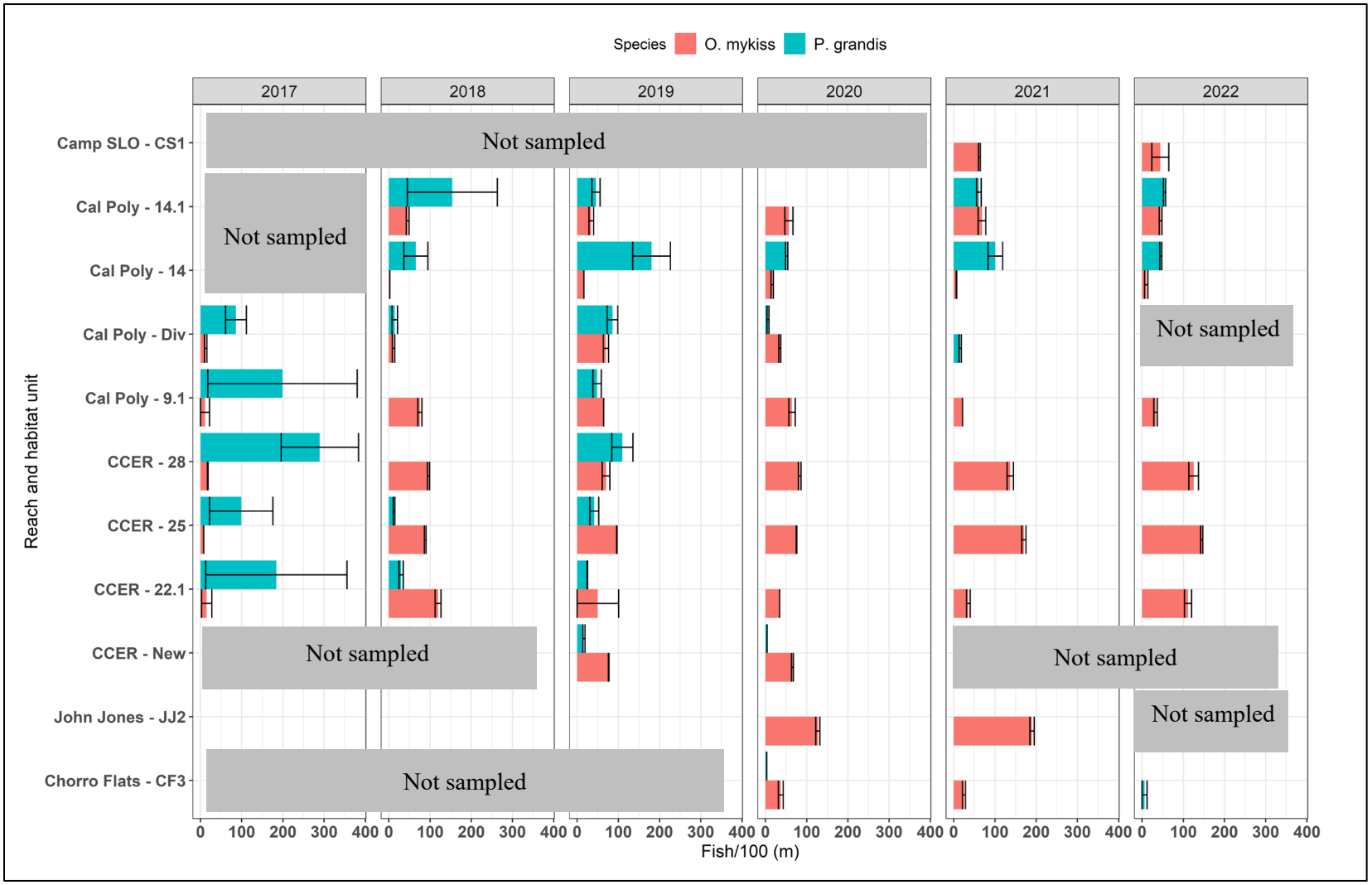


Figure 6. Estimated density for pikeminnow and steelhead with 95% C.I.s for multi-pass backpack electrofishing units in Chorro Creek 2017-2022. Habitat units are ordered from downstream (bottom) to upstream (top).

4 REFERENCES

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